

C L A I M S

1. A negative pressure attraction device

2 characterized by comprising:

3 an attraction nozzle which includes an
4 attracting portion having an air suction port and sucks
5 in air from the air suction port to attract a part to
6 said attracting portion;

7 a negative pressure supply unit which supplies
8 a negative pressure for suction to said attraction
9 nozzle; and

10 an attraction confirming sensor which measures
11 a flow rate of air sucked in from the air suction port,
12 and outputs an electrical signal indicating presence or
13 absence of a part attracted to said attracting portion
14 on the basis of the measured flow rate.

2. A negative pressure attraction device

2 according to claim 1, characterized in that said
3 attraction confirming sensor includes

4 a base arranged in a gas channel,
5 a heater formed as a thin film on a surface of
6 said base,

7 a plurality of temperature sensors formed as
8 thin films on said surface of said base, and

9 detection means for measuring a gas flow rate
10 on the basis of a temperature distribution in the
11 vicinity of said heater which is measured by said

12 temperature sensors.

3. A negative pressure attraction device

2 according to claim 1, characterized by further

3 comprising:

4 a valve which controls suction of air from
5 said attraction nozzle using the negative pressure, and
6 an air suction passage which connects said
7 attraction nozzle, attraction confirming sensor, valve,
8 and negative pressure supply unit to each other.

4. A negative pressure attraction device

2 according to claim 3, characterized in that said

3 attraction confirming sensor includes

4 a flow sensor which detects a change in flow
5 rate of air measured in said air suction passage between
6 said valve and attraction nozzle, and

7 detection means for outputting an electrical
8 signal indicating the presence or absence of a part
9 attracted to said attracting portion on the basis of an
10 output from said flow sensor.

5. A negative pressure attraction device

2 according to claim 4, characterized in that said flow
3 sensor detects a change in flow rate of air measured in
4 a portion of said air suction passage which is in the
5 vicinity of said attraction nozzle.

6. A negative pressure attraction device

2 according to claim 1, characterized in that

3 said attraction nozzle includes a plurality of

4 attraction nozzles which suck in air through the air
5 suction ports by sharing the negative pressure, so as to
6 attract different parts, and

7 said attraction confirming sensor is provided
8 for each of said attraction nozzles.

7. A negative pressure attraction device
2 according to claim 1, characterized in that said
3 attraction nozzle includes an air suction port which is
4 provided to one open end and through which air is sucked
5 in.

8. A negative pressure attraction device
2 according to claim 7, characterized in that said
3 attraction nozzle further includes an air suction hole
4 in which a flow speed of air sucked in through the air
5 suction port by the negative pressure becomes a sonic
6 speed.

9. A negative pressure attraction device
2 according to claim 7, characterized in that said
3 attraction nozzle further includes an air suction hole
4 which has a channel sectional area with such a size that
5 a flow speed of air sucked in through the air suction
6 port by the negative pressure becomes a sonic speed and
7 in which an opening area of the air suction port changes
8 in accordance with a state of a part attracted to said
9 attracting portion.

10. A negative pressure attraction device
2 according to claim 1, characterized in that

3 said attraction nozzle further includes an air
4 suction hole which opens to the air suction port and
5 guides air, sucked in through the air suction port, to a
6 nozzle inner chamber of said attraction nozzle connected
7 to and in contact with said negative pressure supply
8 unit, and

9 said negative pressure supply unit generates a
10 negative pressure with which a pressure at an upstream
11 end of the air suction hole is substantially not less
12 than twice a pressure at a downstream end.

11. An attraction confirming sensor characterized
2 by comprising:

3 a flow sensor which, when a part is to be
4 attracted to an air suction port of an attraction nozzle,
5 measures a flow rate of air sucked in through the air
6 suction port; and

7 detection means for outputting an electrical
8 signal indicating presence or absence of a part
9 attracted to said attracting portion on the basis of an
10 output from said flow sensor.

12. An attraction confirming sensor according to
2 claim 11, characterized in that

3 said flow sensor includes
4 a base arranged in a gas channel,
5 a heater formed as a thin film on a surface of
6 said base, and

7 a temperature sensor formed as a thin film on

8 said surface of said base, and
9 said detection means measures a gas flow rate
10 on the basis of a temperature distribution in the
11 vicinity of said heater which is measured by said
12 temperature sensor.

13. An attraction confirming sensor according to
2 claim 11, characterized in that said detection means
3 outputs an electrical signal indicating presence or
4 absence of a part attracted to the attracting portion of
5 said attraction nozzle on the basis of a change in flow
6 rate of air measured in an air suction passage between
7 said attraction nozzle and a valve which controls
8 suction of air from the attraction nozzle of a negative
9 pressure attraction device.

14. An attraction confirming sensor according to
2 claim 13, characterized in that said detection means
3 outputs an electrical signal indicating presence or
4 absence of a part attracted to said attracting portion
5 on the basis of a change in flow rate of air measured in
6 a portion of said air suction passage which is in the
7 vicinity of said attraction nozzle.

15. An attraction confirming sensor according to
2 claim 11, characterized in that said detection means
3 outputs an electrical signal indicating presence or
4 absence of a part attracted to the air suction port on
5 the basis of a change in flow rate of air sucked in
6 through an air suction hole which includes an air

7 suction port of an attraction nozzle of a negative
8 pressure attraction device as one open end, and
9 in which a flow speed of air sucked in through
10 the air suction port becomes a sonic speed.

16. An attraction confirming sensor according to
2 claim 11, characterized in that said detection means
3 outputs an electrical signal indicating presence or
4 absence of a part attracted to the air suction port on
5 the basis of a change in flow rate of air sucked in
6 through an air suction hole which includes an air
7 suction port of an attraction nozzle of a negative
8 pressure attraction device as one open end and
9 has a channel sectional area with such a size
10 that a flow speed of air sucked in through the air
11 suction port becomes a sonic speed, and in which an
12 opening area of the air suction port changes in
13 accordance with a state of a part attracted to said
14 attracting portion of said attraction nozzle.

17. An attraction confirming sensor according to
2 claim 13, characterized by further comprising a
3 connector to be connected to said air suction passage.

18. An attraction confirming sensor according to
2 claim 11, characterized by further comprising a board
3 which mounts and holds said flow sensor thereon and
4 which forms a wall of a channel.

19. An attraction confirming sensor according to
2 claim 12, characterized in that said temperature sensor

3 includes

4 an upstream temperature sensor arranged on an
5 upstream side of a gas flowing direction,

6 a downstream temperature sensor arranged on a
7 downstream side, and

8 an ambient temperature sensor arranged near
9 the upstream side of said base.

20. An attraction confirming sensor according to
2 claim 12, characterized in that

3 said base has a cavity at a central portion
4 thereof, and

5 a diaphragm which thermally insulates said
6 temperature sensor and base from each other is further
7 provided on the cavity.